

## WHAT IS CLAIMED IS:

1. A process for preparing an ionic liquid in an electrochemical cell which comprises an anode and a cathode, the process comprises:
  - (1) charging the cell with a first solution comprising the desired cation for the ionic liquid to be produced and a second solution comprising the desired anion for the ionic liquid to be produced;
  - (2) subjecting the cell to electrolysis to produce the desired ionic liquid in solution; and
  - (3) recovering the ionic liquid.
2. The process of Claim 1 wherein the first solution comprises an aqueous solution of an onium salt.
3. The process of Claim 2 wherein the onium salt comprises a cation selected from the group consisting of substituted or unsubstituted ammonium, phosphonium, and sulfonium.
4. The process of Claim 3 wherein the cation is selected from the group consisting of substituted or unsubstituted pyridinium, pyridazinium, pyrimidinium, pyrazinium, imidazolium, pyrazolium, thiazolium, oxazolium, triazolium, imidazolinium, methylpyrrolidinium, isothiazolium, isoxazolium, oxazolium, pyrrolium, and thiophenium.
5. The process of Claim 3 wherein the cation is an ammonium cation substituted by one more groups selected from the group consisting of alkyl and aryl groups.
6. The process of Claim 2 wherein the onium salt comprises an anion selected from the group consisting of halide, hydroxide, formate, alkylsulfate, triflate, trifluoroacetate, perfluoroalkylcarboxylate, perfluoroalkylsulfonate, and methylcarbonate.
7. The process of Claim 1 wherein the second solution is an aqueous solution.
8. The process of Claim 7 wherein the aqueous solution is selected from the group consisting of organic salts, inorganic salts, organic acids, and inorganic acids.
9. The process of Claim 8 wherein the aqueous solution is selected from the group consisting of acetic acid, nitric acid, and salts thereof.
10. The process of Claim 1 wherein the ionic liquid is a hydrophilic ionic liquid.
11. The process of Claim 10 wherein the hydrophilic ionic liquid is selected from the group consisting of BMIM acetate, BMIM nitrate, and BMIM triflate.

12. The process of Claim 1 wherein the ionic liquid is recovered from the ionic liquid in solution by evaporation, reverse osmosis, pervaporization, crystallization, distillation, azeotropic distillation, and drying agents.

13. The process of Claim 12 wherein the ionic liquid is recovered from the ionic liquid in solution by evaporation.

14. The process of Claim 1 wherein the electrochemical cell is divided into two or more compartments by a means for dividing.

15. The process of Claim 14 wherein the means for dividing is selected from the group consisting of a membrane, a nanoporous material, a diaphragm, and asbestos .

16. The process of Claim 15 wherein the membrane is selected from the group consisting of a cation-exchange membrane, an anion exchange membrane, and a bipolar membrane.

17. The process of Claim 1 wherein a gaseous by-product is produced.

18. The process of Claim 17 wherein the gaseous by-product is hydrogen, ammonia, carbon dioxide, or nitrogen.

19. The product of the process of Claim 1.

20. A composition comprising an ionic liquid having a purity greater than 99%.

21. A process for preparing an ionic liquid in an electrochemical cell which comprises an anode and a cathode, the process comprises:

(1) charging the cell with (a) a first solution that when subjected to electrolysis produces the desired cation for the ionic liquid to be produced and (b) a second solution that when subjected to electrolysis produces the desired anion for the ionic liquid to be produced;

(2) subjecting the cell to electrolysis to produce the desired ionic liquid in solution; and

(3) recovering the ionic liquid.

22. The process of Claim 21 wherein the desired cation for the ionic liquid to be produced comprises an onium cation.

23. The process of Claim 22 wherein the onium cation is selected from the group consisting of substituted or unsubstituted ammonium, phosphonium, and sulfonium.

24. The process of Claim 23 wherein the cation is selected from the group consisting of substituted or unsubstituted pyridinium, pyridazinium, pyrimidinium, pyrazinium, imidazolium,

pyrazolium, thiazolium, oxazolium, triazolium, imidazolinium, methylpyrrolidinium, isothiazolium, isoxazolium, oxazolium, pyrrolium, and thiophenium.

25. The process of Claim 21 wherein the second solution is an aqueous solution selected from the group consisting of organic salts, inorganic salts, organic acids, and inorganic acids.

26. The process of Claim 21 wherein the ionic liquid is a hydrophilic ionic liquid.

27. The process of Claim 21 wherein a gaseous by-product is produced.

28. The product of the process of Claim 21.

29. A process for preparing an ionic liquid in an electrochemical cell which comprises an anode and a cathode, the process comprises:

(1) charging the cell with (a) a first solution comprising the desired cation for the ionic liquid to be produced and (b) a second solution that when subjected to electrolysis produces the desired anion for the ionic liquid to be produced;

(2) subjecting the cell to electrolysis to produce the desired ionic liquid in solution; and

(3) recovering the ionic liquid.

30. The process of Claim 29 wherein the desired cation for the ionic liquid to be produced comprises an onium cation.

31. The process of Claim 30 wherein the onium cation is selected from the group consisting of substituted or unsubstituted ammonium, phosphonium, and sulfonium.

32. The process of Claim 31 wherein the cation is selected from the group consisting of substituted or unsubstituted pyridinium, pyridazinium, pyrimidinium, pyrazinium, imidazolium, pyrazolium, thiazolium, oxazolium, triazolium, imidazolinium, methylpyrrolidinium, isothiazolium, isoxazolium, oxazolium, pyrrolium, and thiophenium.

33. The process of Claim 29 wherein the second solution is an aqueous solution selected from the group consisting of organic salts, inorganic salts, organic acids, and inorganic acids.

34. The process of Claim 29 wherein the ionic liquid is a hydrophilic ionic liquid.

35. The process of Claim 29 wherein a gaseous by-product is produced.

36. The product of the process of Claim 29.

37. A process for preparing an ionic liquid in an electrochemical cell which comprises an anode and a cathode, the process comprises:

(1) charging the cell with (a) a first solution that when subjected to electrolysis produces the desired cation for the ionic liquid to be produced and (b) a second solution comprising the desired anion for the ionic liquid to be produced;

(2) subjecting the cell to electrolysis to produce the desired ionic liquid in solution; and

(3) recovering the ionic liquid.

38. The process of Claim 37 wherein the desired cation for the ionic liquid to be produced comprises an onium cation.

39. The process of Claim 38 wherein the onium cation is selected from the group consisting of substituted or unsubstituted ammonium, phosphonium, and sulfonium.

40. The process of Claim 39 wherein the cation is selected from the group consisting of substituted or unsubstituted pyridinium, pyridazinium, pyrimidinium, pyrazinium, imidazolium, pyrazolium, thiazolium, oxazolium, triazolium, imidazolinium, methylpyrrolidinium, isothiazolium, isoxazolium, oxazolium, pyrrolium, and thiophenium.

41. The process of Claim 37 wherein the second solution is an aqueous solution selected from the group consisting of organic salts, inorganic salts, organic acids, and inorganic acids.

42. The process of Claim 37 wherein the ionic liquid is a hydrophilic ionic liquid.

43. The process of Claim 37 wherein a gaseous by-product is produced.

44. The product of the process of Claim 37.

45. A process for preparing an ionic liquid, the process comprises:

(1) producing a precursor solution to the ionic liquid in an electrochemical cell;

(2) converting the precursor solution to the desired ionic liquid; and

(3) recovering the desired ionic liquid.

46. The process of Claim 45 wherein the precursor solution comprises anions selected from the group consisting of hydroxide, carbonate, bicarbonate, acetate, and formate.

47. The process of Claim 45 wherein the conversion comprises employing an acid.

48. The process of Claim 47 wherein the acid is selected from the group consisting of acetic, nitric, triflic, methanesulfonic, and sulfuric.

49. A composition comprising an ionic liquid wherein the purity of the ionic liquid is greater than about 98% by weight.

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